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TELEPHONE INDEX

Emergency:

Ambulance	911
Acton Fire Department 256 Central Street Acton, MA 01720	911 Phone 978-264-9645 Fax 978-263-9887
Acton Police Department 371 Main Street (PO Box 2212) Acton, MA 01720	911 Phone 978-264-9638 Fax 978-263-3501
State Police (General Headquarters) 470 Worcester Road Framingham, MA 01702	508-820-2300
Poison Control and Prevention Center Children's Hospital Boston 300 Longwood Avenue, IC Smith Building Boston, MA 02115	Emergency 800-222-1222 Phone 617-355-6609 Fax 617-730-0521
Occupational Safety & Health Administration Valley Office Park 13 Branch Street Methuen, MA 01844	Emergency 800-321-OSHA (6742) Phone 617-565-8110 Fax 617-565-8115
MA Department of Environmental Protection Spill of Oil or Hazardous Material Central Regional Office 627 Main Street Worcester, MA 01608	Emergency 888-304-1133 Phone 508-792-7650 Fax: 508-792-7621
EPA National Response Center 24-Hour Spill Reporting	Emergency 800-424-8802
Chemtrec 24-hour HAZMAT Communications Center	Emergency 800-262-8200

Chemical Suppliers:

Methanol:

Astro Chemicals, Inc. 126 Memorial Drive Springfield, MA 01104	Phone 800-223-0776 Fax 413-781-7246 www.astrochemicals.com

Sodium Bicarbonate:

Astro Chemicals, Inc.
126 Memorial Drive
Springfield, MA 01104

Phone 800-223-0776
Fax 413-781-7246
www.astrochemicals.com

Operations:

Facility:

Spring Hill Commons Apartments
Harris Street and Great Road
Acton, MA 01720

Phone 866-915-5221

Owner:

Equity Residential
Rebecca Setzman, Environmental Compliance Director
Two North Riverside Plaza, Suite 400
Chicago, IL 60606

Phone 312-928-8471
Fax 312-526-9261
Cell 773-301-8781
rsetzman@eqrworld.com

Equity Residential
Chris Pierce, Area Facilities Manager
60 Walnut Street, 2nd Floor
Wellesley, MA 02481

Phone 781-943-4506
Cell 671-594-0056
CPierce@eqrworld.com

Treatment Plant Operator:

WhiteWater, Inc.
A Division of R.H. White Companies, Inc.
David Boucher
41 Central Street
Auburn, MA 01501

Cell 508-864-0840
Phone 888-377-7678
Fax 508-248-2895
dboucher@rhwhite.com

Consulting Engineer:

Norfolk Ram Group, LLC
Kevin P. Klein, P.E.
One Roberts Road
Plymouth, MA 02360

Phone 508-747-7900 x130
Fax 508-747-3658

Architect:

Wessling Architects
Samuel Moores
1250 Hancock Street, Suite 815N
Quincy, MA 02169

Phone 617-773-8150
Fax 617-773-4902

Sludge Hauler:

SWS Septic (dba The Septic Guys, Inc.)
134 Commonwealth Avenue
Worcester, MA 01604
Phone 508-836-3123

Solids Disposal Facility:

Lowell Regional Wastewater Utility
First Street Boulevard (Route 110)
Lowell, MA 01850
Phone 978-970-4248
Fax 978-441-9579

Backup Solids Disposal Facility:

Fitchburg Wastewater Treatment Facility
718 Main Street
Fitchburg, MA 01420
Phone 978-345-9625

Testing Laboratory:

Rhode Island Analytical
131 Coolidge Street, Suite 105
Hudson, MA 01749-1331
Phone 800-937-2580
Fax 978-568-0078

General Contractor:

R.H. White Companies, Inc.
41 Central Street (PO Box 404)
Auburn, MA 01501
Phone 508-832-3295
Fax 508-832-7084

Major Equipment Supplier:

Siemens
Gerald Griner, Project Manager
1828 Metcalf Avenue
Thomasville, GA 31792
Phone 229-226-5733
Fax 229-228-0312

Equipment Supplier:

David F. Sullivan and Associates
19 Batchelder Road, Suite 2b
Seabrook, NH 03874
Phone 603-474-2484
Fax 603-474-3682

<u>Town Boards:</u>

Acton Board of Health Town Hall 472 Main Street Acton, MA 01720	Phone 978-264-9634 Fax 978-264-9630 boh@acton-ma.gov health@acton-ma.gov
Acton Water District Commission 693 Massachusetts Avenue (PO Box 953) Acton, MA 01720	Phone 978-263-9107 Fax 978-264-0148 www.actonh2o.com
Acton Conservation Commission Town Hall 472 Main Street Acton, MA 01720	Phone 978- 264-9631 concom@acton-ma.gov

<u>Utilities:</u>

Electric -	NStar Electric	800-592-2000
Gas -	Keyspan Energy – New England 62 Second Street Burlington, MA 01803	800-233-5325 800-539-7726
Telephone -	Verizon AT&T	800-870-9999 800-222-0300
Cable -	Comcast	800-266-2278
Water -	Acton Water District Commission 693 Massachusetts Avenue (PO Box 953) Acton, MA 01720	Phone 978-263-9107 Fax 978-264-0148 www.actonh2o.com

<u>Reporting:</u>

MA Department of Environmental Protection (DEP) Division of Water Pollution Control, Central Regional Office 627 Main Street Worcester, Massachusetts 01608	Phone 508-792-7650 Fax 508-792-7621
DEP Emergency Response 24-hour statewide	888-304-1133
Acton Board of Health Town Hall 472 Main St Acton, MA 01720	Phone 978-264-9634 Fax 978-264-9630 boh@acton-ma.gov health@acton-ma.gov

1.0 INTRODUCTION

This manual has been prepared to provide information relating to the operations and maintenance of the wastewater treatment and disposal facilities serving the Spring Hill Commons Apartments in Acton, Massachusetts. The site is presently served by a wastewater treatment system comprised of primary clarification using a pretreatment tank and aerobic Rotating Biological Contactor (RBC), secondary clarification, denitrification, tertiary filtration and ultraviolet disinfection with effluent discharge to groundwater through a subsurface soil absorption system. The tertiary level of treatment provides an elevated measure of environmental protection and nitrogen removal.

The wastewater treatment and disposal facility is designed to handle an estimated 40,000 gallons per day (gpd) with phase 1 flow limited to 20,570 gpd as needed to serve the existing 187 bedrooms at Spring Hill Commons. The effluent disposal system, consisting of two areas of leaching chamber trenches, is designed to accommodate the phase 1 flows only.

The following is a sequential listing of the components comprising the wastewater treatment facility:

- Four (4) 2,000 gallon raw sewage pump chambers, Model ST 5x10-2, with 3'x4' HD AL access hatch with risers above pump chambers
- Eight (8) ITT Flygt Electric Submersible Wastewater Pumps, Model # DP3057-234, equipped with 30' of electric cable and thermal sensors, 2.3 HP, 230 volt single phase, with 3" cast iron discharge connection;
- Four (4) raw sewage valve chambers, Model PC 4x6x5, with 3'x3' HD AL access hatch with risers above valve chambers
- One (1) 20,000 gallon precast concrete pretreatment tank, Model LWT 8x10-20;
- One (1) 16,000 gallon precast concrete flow equalization tank, Model LWT 8x10-16, with 4'x4' concrete riser with 3'x4' HD AL access hatch above tank;
- Two (2) submersible Flygt Model CP-3085/436 RBC feed pumps, 3/60/208 volt, 3 HP, 1740 rpm, rated for 160 gpm at 21' TDH;
- One (1) influent valve chamber, Model PC 4x6x5-high with 3'x3' HD AL access hatch cast into roof of valve chamber;
- One (1) Envirex four-stage RBC, Model 425-LMHH-4-B with four bucket feeds;
- Four (4) Saint-Gobain cylindrical 55-gallon HDPE storage tanks;
- Two (2) LMI Model A171-352S alkalinity adjustment pumps;
- Two (2) LMI Model E701-94S, explosion proof, methanol feed pumps;
- One (1) 10'-0" diameter modular steel secondary clarifier;
- One (1) gravity deep-bed denitrification filter with two (2) filter cells, each with a surface area of 18 square feet;
- Two (2) backwash pumps, 2.0 HP, 1750 rpm, 200-230 volt, 3 phase, 60 cycle motors, capable of pumping 216 gpm at 30' TDH;
- Two (2) mudwell sludge-return pumps, 0.5 HP, 1750 rpm, 200-230 volt, 3 phase, 60 cycle motors, capable of pumping 50 gpm at 17' TDH;
- Two (2) ROOTS™ rotary positive air scour blowers, rated 108 cfm at 6 psi with 7.5 HP, 3 phase, 208 volt, 1750rpm, TEFC motors;

- One (1) SITRANS OCM III open channel flow ultrasonic controller and Partlow MRC 5000 Series Programmable Circular Chart Recorder;
- One (1) Trojan Model No. UV-3050K-PTP ultraviolet disinfection unit;
- One (1) effluent aeration chamber, Model ST5x10-2;
- One (1) 16,000 gallon precast concrete effluent pump chamber, Model LWT8x10-16, with 4'x4' concrete riser with 3'x4' HD AL access hatch above chamber;
- Two (2) submersible alternating final effluent dosing pumps, Flygt Model No. CP-3127/483, 3/60/208 volt, 3 HP, 1740 rpm, rate for 190 gpm at 28' TDH;
- One (1) precast concrete effluent valve chamber, Model PC 4x8x5-high with 3'x3' HD AL access hatch cast into roof of valve chamber;
- Instrumentation, alarms and controls; and
- One (1) 14-outlet distribution box, Model DB-14; and
- One (1) 100kW emergency generator (natural gas) with automatic transfer switch.

This document provides information pertaining to facility permits and approvals, descriptions and discussions of the wastewater treatment and sludge handling facilities, sampling, record keeping, emergency response, safety and equipment maintenance.

An updated copy of this manual, in addition to other pertinent documents and records, is required to be maintained at the facility.

2.0 PERMITS AND APPROVALS

The Massachusetts Department of Environmental Protection (DEP) Division of Water Pollution Control granted final approval of the Sewage Treatment Facility and discharge of 20,570 gpd of treated wastewater effluent to the ground at Spring Hill Commons Apartments in Acton, Massachusetts on January 29, 2007 (Permit No. 831-0). A complete set of the approved final design plans, prepared by Norfolk Ram Group, LLC, entitled "Proposed Wastewater Treatment Facility, Spring Hill Commons" and dated May 31, 2006, must be maintained at the treatment facility at all times.

The owner of the treatment facility shall be responsible for the following throughout the life of the treatment facility:

1. Providing a copy of the contract with a Registered Professional Engineer for overall engineering, operational and consulting services for the treatment works to the DEP Division of Water Pollution Control.

2. A copy of a contract with a state licensed wastewater treatment plant operator for operational services of the treatment works must be submitted to the DEP Division of Water Pollution Control for approval prior to execution by the owner.

3. The owner must notify the DEP when ownership of the treatment facility has been transferred to a new owner of operator.

4. A commitment with a licensed waste hauler and identification of the ultimate sludge disposal facility must be submitted to the DEP Division of Water Pollution Control.

5. The owner must submit an application to renew the ground water discharge permit every five years.

3.0 DESCRIPTION OF WASTEWATER TREATMENT FACILITIES

This section provides a description of the various treatment plant components and their function. Each component is presented in sequential order and discussed individually in the following sections.

3.1 Pretreatment Tank

The pretreatment system consists of one (1) precast septic tank with a capacity of 20,000 gallons located adjacent to the treatment plant building. The pretreatment tank serves to remove primary solids and floating debris in the raw wastewater. The pretreatment tank also provides for storage of waste solids generated by the treatment process.

The waste solids primarily consist of particles of the organic mat covering the RBC, which regularly shear off and pass into the clarifier. Floating particles, or scum, are skimmed off the top of the clarifier into a collection trough. Sinking particles, or sludge, settle to the bottom, where they are raked into a hopper.

Blowers located in the treatment plant building automatically operate two separate air-lift systems; one for the scum, and one for the sludge. These systems recycle the solids to the pretreatment tank via a waste solids return line. Both waste solids streams will be stored within the pretreatment tank, along with primary solids from incoming raw water, until removal by a septage pumping truck.

The denitrification filter provides another source of waste solids. Each filter cell undergoes an air-scour/backwash cycle automatically controlled via float switches and timers activated when solids have accumulated on the filter media to such an extent that the movement of water through the media has slowed. Backwashing results in a volume of water laden with solids removed from the filter media. These solids are also returned to the pretreatment tank via the waste solids return line.

As mentioned above, all primary solids and floating debris will be stored in the pretreatment tank. The pretreatment tank is designed to provide eighteen (18) hours liquid detention time for the phase 1 design flows and to accommodate approximately one year's worth of sludge without appreciably diminishing the function of the primary clarification. This accumulated sludge must be removed from the pretreatment tank at least once every year by a septage waste hauler licensed through the state and town. Floating scum may occupy more space, and therefore it is recommended that scum be removed twice each year.

The operator may find that more frequent removal of these wastes is necessary. Consequently, the pretreatment tank should be monitored on a regular basis with pumping arranged when the sludge depth reaches approximately 4'-0" or when scum thickness exceeds 2'-0".

A complete laboratory analysis of the sludge should be performed by a certified laboratory prior to removal of this material. Since the treatment plant will service residential dwellings, there will be no industrial wastes disposed into the system. The sludge is anticipated to display properties similar to those produced at other facilities treating domestic sewage. It is expected that the sludge produced at the facility will be transported by a licensed septage hauler to an approved sludge disposal facility.

This sludge material is non-hazardous and can be expected to exhibit characteristics shown in Table 3.1.

TABLE 3.1 - Typical Sludge Characteristics

	Range	Typical
Total dry solids (TS), %	6.0 - 12.0	10.0
Volatile solids (% of TS)	30 - 60	40.0
Grease and fats (ether soluble, % of TS)	5.0 - 20.0	
Protein (% of TS)	15 - 20	18
Nitrogen (N, % of TS)	1.6 - 6.0	3.0
Phosphorous (P_20_5, % of TS)	1.5 - 4.0	2.5
Potash (K_20, % of TS)	0.0 - 3.0	1.0
Cellulose (% of TS)	8.0 - 15.0	10.0
Iron (not as sulfide)	3.0 - 8.0	4.0
Silica ($Si0_2$, % of TS)	10 - 20	15.0
pH (standard units)	6.5 - 7.5	7.0
Alkalinity (mg/l as $CaCO_3$)	2,500 - 3,500	3,000

(Source: Metcalf & Eddy, Wastewater Engineering, 1972)

It is anticipated that the Groundwater Discharge Permit for potential future phases of the wastewater treatment plant may include provisions that require phosphorus removal. In order to readily accommodate this possibility, an area has been identified for the potential installation of either a second pretreatment tank, or more likely, a segregated secondary sludge holding tank.

3.2 Flow Equalization Tank

One (1) precast reinforced concrete flow equalization tank, with a capacity of 16,000 gallons, is located adjacent to the treatment facility. Effluent from the pretreatment tank flows via gravity to flow equalization tank. Two submersible RBC feed pumps are located in the flow equalization tank. The pumps are mounted on a slide rail system situated below an access hatch to facilitate pump removal without requiring entrance into the tank.

The flow equalization tank attenuates and stores peak flows allowing a constant rate of influent loading to be directed to the treatment facility. This is accomplished through a combination of float switches located in the flow equalization tank and the aerobic RBC feedwell. At full capacity, the flow equalization tank float switches and RBC feedwell float switch control pump operation as follows:

- The LOW WATER Flow Equalization Tank float stops the pumps maintaining a minimum liquid level above the pump suction ports and alternates the pumps.

- While the Flow Equalization Tank water level is above the LOW WATER float, the Flow Equalization Tank pump operation is controlled by the RBC floats located within the RBC feedwell.

- This operation is over-ridden by the LEAD PUMP ON float, which then enables continuous pumping and triggers an alarm. This continuous pumping will continue for a preset timer-controlled amount of time to alleviate high water conditions.

- The LAG PUMP ON / HIGH WATER ALARM floats start the second pump, if the first pump alone is not working or cannot keep up with the wastewater flow and initiates the high water alarm.

The treatment facility operator will be able to maximize treatment efficiency by adjusting pump float switches, timers, and recycle rates to control the rate of flow through the treatment processes. Maintenance of the flow equalization tank includes periodic visual inspection to check for solids accumulation and fouling of the float switches. The pumps must be maintained in accordance with the manufacturers' recommendations.

3.3 Aerobic Rotating Biological Contractor

Aerobic biological treatment is utilized for the removal of dissolved organic matter (measured as Biochemical Oxygen Demand) and to accomplish oxidation of reduced forms of nitrogen (nitrification). These treatment processes are achieved via the use of partially submerged Rotating Biological Contactor (RBC) that employs an aerobic attached growth biological system utilizing a series of polyethylene discs, mounted on a steel shaft. The RBC shaft is rotated to achieve an approximate peripheral velocity of 60 feet/minute with roughly 40 percent submergence in the wastewater. The microorganisms naturally present in the environment, (primarily bacteria, but also other simple life forms such as algae, protozoa, and rotifers), adhere to the discs forming a biological slime layer. This biological layer utilizes the soluble organic compounds in the wastewater as a source of energy and as a supply of the basic elements necessary in the production of new cellular material. Rotation of the media alternately exposes the organisms to their food, the soluble organic matter, and to the atmosphere which provides the oxygen needed for respiration.

Shearing forces exerted on the organisms during rotation through the wastewater cause excess growth to slough from the media into the wastewater solution (referred to as mixed liquor). The mixing action of the rotating media keeps the sloughed solids suspended in the mixed liquor. Subsequent processes of clarification and filtration separate the phases, producing a clarified liquid effluent and a waste sludge.

Under normal operating conditions, the coloring of the biological growth on the RBC will be gray to brown. However, when nitrification is occurring, the latter stages of the media will typically be light brown to golden-brown due to the presence of nitrifying bacteria. The presence of these bacteria provides an indication that the preceding stages of the RBC have accomplished a high degree of carbonaceous BOD removal. In contrast, a predominantly white growth indicates reduced treatment efficiency due to the presence of filamentous (difficult to settle) organisms. There is no reason for concern if white growth is present on limited areas because it is possible for such growth to occur on properly operating RBC.

Maintenance of the RBC includes daily visual inspection, both to ensure proper operation and to check the coloration of the biological growth. Abrupt changes in color or excessive loss of growth may indicate a reduction in treatment efficiency or the presence of a substance that is toxic to the organisms. Daily dissolved oxygen, temperature and pH measurements may also be used to provide an indication of the condition of the biological treatment system.

The wastewater treatment facility has been equipped with various recycle and process control options to enable the operator to optimize treatment efficiency. The nitrified effluent from the aerobic RBC can be recirculated back through the flow equalization tank. This mode of operation encourages passive denitrification within the anoxic environment of the flow equalization tank and thereby reduces the dependency on methanol.

Periodic maintenance of the RBC includes routine shaft lubrication, load cell readings and motor maintenance as recommended by the manufacturer.

3.4 Alkalinity Adjustment

Dissolved constituents of the domestic water supply generally contribute alkalinity to the wastewater. During the biological process of nitrification, however, bicarbonate alkalinity is consumed and the pH of the wastewater may be lowered. Since the optimum pH range for nitrification is between 7.5 and 8.5 standard units, supplemental alkalinity may be required.

The treatment facility includes provisions for the addition of alkalinity. As deemed necessary, alkalinity adjustment will be achieved by caustic soda or sodium bicarbonate addition to the aerobic RBC inlet piping. The chemical will be stored in a 55-gallon high density polyethylene (HDPE) tank, equipped with a mixer and metering pump.

The alkalinity adjustment system pumps are operated by a duplex control system mounted in the Equipment Control Panel and interfaced with the low liquid level mercury float switch and the pump on mercury float switch installed in the Flow Equalization Tank. In the automatic mode of operation, the alkalinity adjustment system feed pumps will start whenever the RBC feed pumps are utilized. Controls for the alkalinity pumps consist of H-O-A switches and run lights. The alkalinity adjustment system pumps are be interfaced with the central alarm and emergency power systems. Controls for the alkalinity mixer consist of an ON/OFF switch and run light.

3.5 Secondary Clarifier

The facility is equipped with one (1) ten-foot diameter circular mechanical clarifier. The secondary clarifier provides a quiescent settling zone for the capture of solids generated by the RBC. Settled solids are directed via a rotating sludge rake to a hopper located in the center of the clarifier. Similarly, scum that accumulates on the surface of the unit is directed to a scum cup. The collected sludge and scum are removed hourly by an air-lift system and directed to the pretreatment tank for storage. The air-lift system is controlled by automatic valves located at the blowers, which in turn are controlled by a Programmable Logic Controller (PLC) in the Equipment Control Panel.

Maintenance of the secondary clarifier consists of daily visual inspection to ensure proper operation of the surface skimmer, sludge rake, and blower. The drive motor and shaft must be maintained as recommended by the manufacturer. Special attention should be given to the duration of scum and sludge removal so as to maintain efficient clarification. Usually, removal of scum for one-minute intervals, and sludge for one to three minute intervals each hour is sufficient.

Close attention should also be paid to the effluent weir, which should be periodically cleaned to prevent solids build-up and excessive weir clogging.

3.6 Denitrification Filter

During the biological treatment of sewage, a series of biochemical reactions known collectively as nitrification, convert the reduced nitrogenous compounds present within the wastewater to the completely oxidized nitrate-nitrogen (NO_3-N) form. In recent years, a variation in the tertiary sand filter polishing process has proven extremely successful in providing an additional treatment phase known as denitrification. This process utilizes submerged granular media in airtight vessels designed to starve the organisms of free oxygen. Bacteria functioning in the anoxic (devoid of free dissolved oxygen) environment utilize combined forms of oxygen for respiration thereby converting the nitrate-nitrogen present in the wastewater to nitrogen gas.

Denitrification filters are similar in principle to tertiary filters, both are polishing filters designed to remove solids not settled in the clarifier, however, the media in the anoxic filters is completely submerged in the wastewater promoting an anoxic environment that allows the predomination of denitrifying organisms. The denitrifying bacteria require biodegradable organic material (carbon) as a source of food. As the aerobic bacteria in the preceding processes (oxidation of carbonaceous matter and nitrification) have consumed most of the organic matter in the wastewater, a supplemental carbon source must be provided to sustain the life processes of the denitrifying bacteria thereby ensuring completion of the denitrification reactions.

Methanol (wood alcohol) is a highly soluble source of carbon and therefore is generally used as a supplemental carbon source. Methanol contributes to high denitrification rates and produces less excess biological cell growth than most other alternate carbon sources.

Effluent total nitrogen concentrations less than the primary drinking water standard of 10 mg/1 and total nitrogen removals in excess of ninety percent have been consistently achieved at plants equipped with denitrification filters and properly monitored methanol feed systems. The efficiency of this particular unit operations is, however, directly dependent on the ability of the facility's operator to monitor the system and to make the appropriate process adjustments. An insufficient supply of methanol inhibits the growth of the denitrifying bacteria, thus reducing the overall efficiency of the process. Alternately, excess methanol contributes to elevated effluent BOD_5 levels. Therefore, it is imperative that this unit process be closely monitored to ensure that complete nitrification is taking place.

On (1) four cell denitrification filter has been provided to ensure wastewater denitrification. The unit is situated such that it follows the clarifier in the flow train. As the filter collects solids in the media bed, the flow rate through the media will slow, and a filter backwash will be needed. An initial air scour is performed to breakup the solids and move them into suspension within the wastewater. After the air scour is complete, a quick settling period is done to allow the filter media to settle out of suspension. The final step is the liquid backwash, which involves taking the effluent wastewater stored in the clearwell, and pumping it through the media to remove the dirty wastewater from the filter. All backwash water is returned to the pretreatment tank via the waste solids return line. The entire process is initiated and controlled using timers and float switch overrides.

Maintenance of the filter includes daily inspection to ensure that the general operation of the filter is satisfactory. Particular attention should be given to the float switches, the blower operation and the amount of methanol use. The operator should record the number of backwashes that have occurred during the previous 24 hour period (read directly from counters in the Equipment Control Panel). The backwash pumps, mudwell pumps and blowers must be maintained as specified by the manufacturer.

3.7 Methanol Feed System

The sewage treatment facility is equipped with an automatic, flow proportional, chemical feed unit designed to regulate the rate of methanol addition based upon the effluent flow. Self-priming peristaltic pumps deliver the methanol solution from a 55-gallon HDPE storage tank to the 6" PVC clarifier effluent line that feeds the denitrification filter. Methanol feed is controlled through the PLC. As a precaution, the methanol supply is stored in a totally enclosed, fully ventilated room accessed from the exterior of the building. Methanol exhibits a fire hazard, and therefore, only explosion proof electrical equipment should be used in the room.

The methanol feed pumps are operated by a duplex control system mounted in the Equipment Control Panel and interfaced with the effluent flow meter installed in the Denitrification Filter. The methanol feed pumps have initially been set to provide 100% feed rate at 200 gpm and to stop at 0 gpm. Controls for the methanol feed pumps consist of H-O-A switches and run lights. The methanol feed pumps are be interfaced with the central alarm and emergency power systems.

3.8 Disinfection / Flow Measuring

Effluent disinfection is achieved through the use of a Trojan Technologies, Inc. ultraviolet disinfection system installed following the denitrification filter in the flow train. The disinfection unit is capable of treating 50,000 gallons per day of treated, filtered effluent. Maintenance of the disinfection unit includes daily inspection to ensure proper operation and to verify the condition of the ultraviolet bulbs.

The treated, disinfected effluent is then passed through a flow measuring weir box fitted with a SITRANS OCM III ultrasonic flow measuring system and a concurrent Partlow circular chart recorder. The equipment is designed to measure daily total, peak and minimum flows, and is capable of storing the information for up to one year. The total and peak flows for the plant should be recorded daily by the operator. Maintenance of the flow measuring system should include daily inspection of the electronics to ensure proper operation, as well as periodic cleaning of the weir to remove built up growth and solids.

3.9 Final Effluent Aeration Chamber

The effluent from the treatment facility will be aerated prior to discharge. This aeration step is intended to drive off the nitrogen gas produced through denitrification and to strip unused methanol and other volatile substances from the wastewater.

The final effluent aeration process utilizes fine bubble diffusers installed in the concrete aeration chamber. Air is supplied by the plant blowers located in the treatment facility building and is controlled through a timer and solenoid valves.

3.10 Final Effluent Pump Chamber

Treated, aerated effluent from the post aeration chamber enters the final effluent pump chamber (a.k.a. effluent dosing chamber) located near the southeast corner of the treatment building. This chamber is equipped with two submersible pumps, Flygt Model CP-3127/483. The pumps are mounted on slide rail systems to facilitate removal through a surface hatch, without requiring entrance into the chamber. Pump operation is controlled via four floats, suspended in the chamber and situated as follows:

- the low water "pump off" float maintains a minimum liquid level above the pump suction ports and changes the lead pump;
- the "lead pump on" float initiates the discharge of treated effluent;
- the "lag pump on-high water alarm" starts the lag pump or second pump and initiates an alarm that warns of high effluent flow conditions or in the event of a lead pump failure. The alarm is sounded whenever this float is tripped.

Pump chamber maintenance includes periodic visual inspection to check float and pump operation. The pumps must be maintained as recommended by the manufacturer.

3.11 Effluent Disposal

The treated, disinfected, aerated effluent is discharged to the ground via a soil absorption system consisting of Cultec Recharger leaching chambers. The effluent disposal facility is separated into two equally sized halves using a total of thirteen (13) three-foot wide leaching chamber trenches. Seven (7) trenches are 63± feet long, and six (6) trenches are 76± feet long. The approximate dimensions of the entire leaching area (discharge facility footprint) are 150 feet long by 57 feet wide, providing a total area of approximately 8,000 square feet. This results in a theoretical effluent loading rate of approximately 2.6 gallons per day per square foot. The estimated discharge rate is below the allowable loading rate of 3.0 gallons per day per square foot.

3.12 Monitoring Wells

Three (3) monitoring wells, installed both up gradient and down gradient of the leaching facilities, will be used to analyze and monitor groundwater. The locations of the wells are shown on the plan entitled "Groundwater Monitoring Plan, Spring Hill Commons, Acton, Massachusetts".

The monitoring wells shall be sampled and tested for the parameters specified below:

Parameter	Frequency
Static Water Level	Quarterly
pH	Quarterly
Specific Conductance	Quarterly
Total Nitrogen	Quarterly
Nitrate-Nitrogen	Quarterly
Volatile Organic Compounds	Annually

3.13 Special Design Features

The facility has been designed to provide safe and efficient operation. The design also includes contingencies intended to prevent any bypassing of treatment processes in the event of a system failure.

Redundancy: Duplicate pumps have been installed wherever pumping is required. Each of these pumping systems is capable of handling the peak daily flow with the largest unit out of service.

Emergency Generator: The treatment plant is connected to an emergency generator sized to perform a sequential start-up and to operate the entire facility including all pumps, treatment processes and lighting. The treatment facility's main control panel is equipped with an automatic transfer switch designed to activate the emergency generator in the event of a prolonged power outage. A sequential starter is also included to prevent an overload of the circuit upon transfer to or from the alternate electric source. The 100-kW emergency generator is powered by natural gas and located outside the treatment plant.

Alarms: Alarms are provided to signify high water level or failure of any pump, motor, drive unit or compressor. The alarm system includes visual and audible alarms at the treatment plant and a phone auto-dialer that will notify the plant operator of any failure.

Spare Parts Inventory: An on-site inventory of high wear items must be maintained at the treatment plant to facilitate repairs. A complete updated listing of spare parts is included in this Operation and Maintenance manual in Section 11.1.

Methanol Storage: Methanol is stored in a fully enclosed room accessible only from the exterior of the building. The door for the methanol storage room opens outward and is equipped with a panic bar opener. Only explosion-proof electrical components are to be utilized within the methanol storage area. The storage room walls and ceilings are sealed, vapor tight, and constructed with a two hour minimum fire rating.

Safety Equipment: Pertinent safety equipment including a first aid kit, fire extinguisher, emergency lighting and smoke detectors should be maintained onsite at all times. An emergency eye wash station is installed within the treatment plant building.

Control Room: All electrical controls are located in a separate room to prevent malfunction due to contact with moisture or corrosive gasses. Electrical fixtures are non-corrosive and moisture proof.

Ventilation: The treatment facility building is equipped with an automatic venting device. Process area ventilation is sized to provide twelve (12) complete air changes per hour. An automatic time with light switch override is also furnished. Ventilation for the office and laboratory, electrical control room and restroom is sized to provide at least five air changes per hour. The methanol room is equipped with a passive venting system of louvers to prevent the accumulation of potentially deadly gases.

Potable Water: The plant is provided with potable water for sanitary and equipment washdown. The water supply to the plant is from a public service connection. The system is protected by an approved backflow prevention device provided in accordance with the requirements of the Massachusetts Department of Environmental Protection.

Accessories: Hose bibs and floor drains are provided to facilitate cleanups. An employee restroom is also provided.

4.0 DESCRIPTION OF SLUDGE HANDLING FACILITIES

4.1 General

The treatment process utilized at the Spring Hill Commons Wastewater Treatment Facility generates waste solids that require handling separate from the wastewater treatment system. Waste solids include primary solids and secondary sludge and scum captured by the clarifier and the denitrification filter. The clarifier collects the greatest quantity of secondary sludge because of its location immediately following the RBC in the process train. Both sludge and scum are removed from the secondary clarifier on an intermittent timed basis by means of airlift pumps (see Section 3.5). The removal frequency is usually on an hourly basis controlled by the PLC in the equipment control panel. All waste solids collected in the clarifier are directed to the pretreatment tank.

The denitrification filter collects solids as a natural part of the filtration process. Waste solids are generated when the filter cells are backwashed. Solids laden backwash water flows from the filter cells to the sludge return line and is ultimately discharged to the pretreatment tank.

All solids generated by the treatment plant are collected and stored in the pretreatment tank. Consequently, the pretreatment tank should be monitored monthly to check the sludge depth and scum thickness. The sludge collected in this tank must be removed by a sewage pump truck yearly. In addition, the scum that accumulates on the liquid surface of this tank should be removed at least twice each year.

4.2 Designated Sludge Hauler and Disposal Facility

Sludge Hauler: SWS Septic (dba The Septic Guys, Inc.)
134 Commonwealth Avenue
Worcester, MA 01604
Phone 508-836-3123

Disposal Facility: Lowell Regional Wastewater Utility
First Street Boulevard (Route 110)
Lowell, MA 01850
Phone 978-970-4248
Fax 978-441-9579

Backup Disposal Facility:
Fitchburg Wastewater Treatment Facility
718 Main Street
Fitchburg, MA 01420
Phone 978-345-9625

5.0 PERSONNEL

5.1 Qualifications

The facility will be staffed by a Chief Operator and Back-up Operators who must devote part of their time to general attention of plant process operations, daily report requirements, and routine housekeeping and maintenance chores. The majority of the operator's time will be spent conducting laboratory testing, equipment maintenance and repair, and general plant process attention. In order to ensure proper and efficient operation of a sewage treatment facility, it is necessary to have sufficient and qualified personnel on staff.

The chief operator of the Spring Hill Commons Wastewater Treatment Facility must be certified by the State Board of Certification of Operators of Wastewater Treatment Plants in accordance with the requirements of 257 CMR 2.00 and shall have the following qualifications:

Grade: Commonwealth of Massachusetts minimum Grade 4 Wastewater Treatment Plant Operators license.

Experience: At least one year as a Grade 4 Operator working under the supervision of an operator with a Grade 4 License.

A backup operator possessing at least a Grade 3 license must also be designated.

All other personnel employed at the facility shall be familiar with the operations of wastewater treatment facilities. Such personnel shall work under the direction and supervision of the chief operator.

The advantages of training courses for wastewater treatment plant operators are obvious. This training, along with experience, will provide the operators with the technical background necessary to properly operate the plant and to obtain the required operator's certification license.

Every effort should be made to provide continuing education and training for all plant personnel. Operators should take advantage of those courses offered in the Commonwealth of Massachusetts.

Subscription to trade magazines and membership in the local chapter of Water Pollution Control Federation will also aid in providing continuing education.

5.2 Personnel

The Owner shall employ sufficient personnel to ensure the proper operation of the facility. At a minimum, the Owner shall employ a chief operator with the qualifications outlined in Section 5.1. An assistant operator shall be available to perform plant duties in the absence of the chief operator. Either the chief operator or his/her assistant shall be at the facility at least 5 days each week. Each visit shall be of sufficient duration, at least 2 hours to permit the proper inspection of equipment and to check the performance of equipment and perform other daily duties. The chief operator or his/her assistant shall be on call 24 hours a day, seven days a week, in the event of an emergency.

6.0 SAMPLING & ANALYSIS

6.1 Daily Sampling

The influent waste stream and effluent from the facility shall be tested on a daily basis to determine its pH. The operator should have the capability of conducting this test at the facility. Flow shall also be recorded on a daily basis.

6.2 Influent Sampling

The influent to the facility shall be sampled and tested for the parameters specified below:

Parameter	Frequency
BOD_5	Monthly
Total Suspended Solids	Monthly
Total Solids	Monthly
Ammonia-Nitrogen	Monthly
Volatile Organic Compounds	Annually

The BOD_5, TSS, TS, Ammonia-Nitrogen samples shall be 24-hour composite samples while the Volatile Organic Compounds samples shall be grab samples. Any grab sample or composite sample required to be taken less frequently than daily shall be taken during the period of Monday through Friday, inclusive. All composite samples shall be collected over the operating day.

6.3 Effluent Sampling

The effluent from the facility shall be sampled and tested for the parameters specified below:

Parameter	Frequency
Flow (Max-Min-Average)	Daily
pH	Daily
BOD_5	Monthly
Total Suspended Solids	Monthly
Total Solids	Monthly
Oil and Grease	Monthly
Total Nitrogen	Monthly
Nitrate-Nitrogen	Monthly
Fecal Coliform	Monthly
Surfactants	Monthly
Ammonia-Nitrogen	Monthly
Volatile Organic Compounds	Annually

The BOD_5, TSS, Total Solids, Total Nitrogen, Nitrate-Nitrogen, and Ammonia-Nitrogen samples shall be 24-hour composite samples while pH, Oil and Grease, Chlorides, Fecal Coliform, Surfacatants, and Volatile Organic Compounds shall be grab samples. Any grab sample or composite sample required to be taken less frequently than daily shall be taken during the period of Monday through Friday, inclusive. All composite samples shall be collected over the operating day.

6.4 Monitoring Well Sampling

The quality of the groundwater in three (3) monitoring wells shall be sampled and tested for the parameters at the frequency specified below:

Parameter	Frequency
Static Water Level	Monthly
pH	Monthly
Specific Conductance	Monthly
Total Nitrogen	Quarterly
Nitrate-Nitrogen	Quarterly
Volatile Organic Compounds	Annually

6.5 Process Monitoring

The entire treatment plant has been designed to be fully automated, controlled by a PLC located within the Equipment Control Panel. All time sequences have been preset based upon experience at other similar installations and manufacturer's recommendations. There are no routine process control functions to be performed by the operator and adjustments should only be necessary in the event of an unusual circumstance.

The treatment plant has been designed to minimize operator attention requirements. Wastewater analysis is only necessary to monitor overall plant performance and to identify and correct specific problems. The laboratory analysis required by the Massachusetts DEP in the facility's discharge permit will provide an important chronology that will enable the plant operator to interpret and predict unusual events. This data needs only to be supplemented with a record of daily visual and olfactory observations.

Routine testing that is required of the plant operator is limited to pH monitoring of the influent and final effluent. Microbiological examination of the media, dissolved oxygen and pH monitoring, and settleability tests may become necessary if a problem is detected.

The pH of the effluent should be within the range of 6.5 to 8.5 as specified in the facility's discharge permit. A value outside of this range for extended periods of time will result in an overall decrease in plant efficiency. A low pH value is of particular concern, as this will affect the plant's ability to remove nitrogen. The incoming sewage should have sufficient alkalinity present to maintain a pH within the 6.5 to 8.5 standard units range without chemical addition. If influent or effluent monitoring indicates a pH value below 6.5, the plant operator should begin daily pH and alkalinity measurements of the plant influent and aerobic RBC effluent to determine if pH and alkalinity adjustments are necessary. If this condition occurs the operator should initiate use of an alkalinity adjustment system utilizing sodium bicarbonate addition. This system shall be used as needed to maintain proper pH conditions in the RBC effluent.

A visual inspection should be made of all of the facility's unit processes each day of operator coverage. Particular attention should be given to the biomass appearance on the RBC media. The stages that are strictly utilized for organic removal should typically exhibit a biomass that appears as a gray shaggy mass. Since a higher percentage of carbonaceous material is removed in the initial stages, the first and second stages should experience the thickest biofilm growth. In the subsequent nitrifying stages, the growth will be much thinner, less shaggy, and more golden brown in appearance. This growth may also be very irregular in thickness because of the activity of predators, such as a protozoa, rotifers, and worms. Slight to moderate sloughing or stripping of the biomass should be evident.

It is not uncommon to develop organisms on the contactor media that appear white in color. There is no immediate need for concern if the white organisms (probably thiothrix or beggiatoa) appear in limited areas on the media. Should this form of biomass begin to dominate the surface, however, reduced process performance levels will occur. The most probable cause of these organisms is high hydrogen sulfide concentrations in the influent wastewater. The predomination of a white filamentous growth on the contactor media may also be the result of an organic overload on the first stage of the process. The solution in this case is to provide a larger amount of surface area on the first stage. This may be accomplished by adjusting the baffles between stage one and two. If this condition occurs the consulting engineer should be contacted.

Excessive biomass sloughing is generally an indication of toxic substances within the wastewater. Should the operator observe excessive loss of biomass, the facility's consultant engineer should be notified immediately to initiate a program to identify and isolate the problem.

The detection of abnormal or objectionable odors in the treatment plant can also serve as an early warning of possible operational problems. Many gases are produced during the collection, transportation, and storage of wastewater. Fresh domestic sewage has a slight odor usually described as musty. When depleted of dissolved oxygen (DO), malodorous compounds such as hydrogen sulfide are emitted. The RBC process is designed to maintain a positive dissolved oxygen content in the wastewater and therefore, the system should not be a source of objectionable odors. Slight odors may be noticed around the plant influent area, which utilizes an anoxic septic tank for pretreatment. Routine dissolved oxygen monitoring is not necessary for process control. However, should odors be detected within the treatment plant building, the dissolved oxygen level within each stage of the RBC should be checked and the consulting engineer contacted. The plant operator should refer to the operation and maintenance manuals of the individual equipment suppliers located in the appendices of this report for additional details on problem identification and appropriate corrective measures.

Should an operational problem occur, the operator may find the need to conduct additional wastewater testing during the month to aid in identifying the problem. Such testing should be performed at the operator's discretion and might include:

- raw wastewater temperature, pH and alkalinity;
- aerobic RBC influent and effluent ammonia and nitrate-nitrogen concentrations;
- aerobic RBC influent and effluent BOD_5.

6.6 Sampling and Laboratory Protocol

All sampling, sample preservation and analyses shall be performed utilizing procedures approved by the DEP. In addition, influent, effluent and groundwater samples shall be analyzed by a laboratory certified by the Commonwealth of Massachusetts.

6.7 Equipment Calibration

A pH meter should be maintained at the treatment plant for use by the plant operator in monitoring the pH of samples collected as required in the facility's discharge permit. The meter should be calibrated against standard solutions of known pH each day prior to its use. A fresh supply of standard solution should be obtained each month from the contracted laboratory.

The plant operator should refer to the instructions provided with the pH meter for more comprehensive details on proper calibration procedures. The use and care of the instrument should be in strict accordance with the manufacturer's recommendations.

7.0 FACILITY RECORDS & REPORTING

The operator shall maintain a daily log of plant operations, process changes and equipment maintenance. At a minimum, the following information should be recorded in the facility's log:

- results of daily and monthly influent and effluent monitoring as required in the discharge permit;
- results of daily and monthly monitoring of other wastewater parameters and sample sites;
- results of quarterly and annual monitoring of the monitoring wells;
- date and quantity of sludge removed from the facility;
- physical changes in the biological growth on the RBC;
- process changes;
- equipment maintenance records;
- equipment failures and replacements; and,
- emergency situations.

Copies of the daily logs, as well as the Consulting Engineer's monthly inspection reports, shall be kept at the facility at all times.

The operator shall also report any of the following to the DEP Division of Water Pollution Control, Central Regional Office:

- planned physical alterations and additions to the facility;
- anticipated non-compliance;
- occurrence of a facility non-compliance (reported within 24 hours); and
- any proposed sewer connections or changes of a present sewer user.

All facility record keeping and reporting shall meet the requirements of the Massachusetts Ground Water Discharge Permit Program (314 CMR 5.00).

Record keeping and reporting on the operation of the treatment plant and related appurtenances must also conform to the provisions of 314 CMR 12.07. Specifically, monthly operating records shall be maintained by the plant operator in accordance with the most recent edition of the Department of Environmental Protection, Division of Water Pollution Control's publication entitled "Directions for Completing Monthly Report Forms for Wastewater Treatment Plants" and submitted on forms supplied by the Division. A copy of the regulations, instructions and reporting forms supplied by the Division are included in Appendix B.

Additional provisions relating to monitoring requirements, compliance schedules, planned changes, and 24-hour reporting are contained in DEP division regulations (314 CMR 5.00). Copies of these regulations, which are incorporated in the general conditions section of the facility's discharge permit, are also provided in Appendix B.

The Department of Environmental Protection requires that inspections of the treatment plant be completed by a Massachusetts Registered Professional Engineer knowledgeable in wastewater treatment processes. These inspections are required at least once a month to inspect the operation of the collection, treatment, and disposal facilities and to consult with the plant operator. During these visits, the engineer will review the facilities operation and maintenance records, check the monitoring reports and inspect the treatment, sampling and flow measurement equipment.

8.0 EMERGENCY OPERATIONS & RESPONSE

8.1 Fire and Medical Emergencies

The following agencies shall be contacted when a fire or medical emergency occurs at the treatment plant:

	Emergency	Business
• Ambulance	911	
• Acton Fire Department	911	978-264-9645
• Acton Police Department	911	978-264-9638

A fire at the facility also necessitates that the Department of Environmental Protection, Division of Water Pollution Control, Central Regional Office be contacted.

A written report shall be prepared following any fire emergency assessing damage to the facility and proposing a schedule of remedial action. This report shall be sent to the agencies listed in Section 8.2.

If possible, all electrical power to the facility and emergency generator should be shut down during fire emergencies.

8.2 Spill Control and Reporting

In the event of an overflow or accidental spillage of untreated wastewater or sludge, the following authorities shall be contacted immediately:

Department of Environmental Protection Division of Water Pollution Control Central Regional Office 627 Main Street Worcester, Massachusetts 01608	508-792-7650
DEP Emergency Response (24-Hour Statewide)	888-304-1133
Acton Board of Health 472 Main Street Acton, Massachusetts 01720	978-264-9634

A written report shall be prepared, and submitted to the above agencies, describing the event, required remedial actions and the steps to prevent a future occurrence.

8.3 Emergency Conditions

Emergency conditions can be imposed on a treatment system by natural disasters, civil disorders, faulty maintenance, negligent operation and accidents. Planning is essential to ensure continued effective operation during emergency situations

This chapter of the Operations and Maintenance Manual provides a detailed account of the emergency response plan necessary for ensuring the continued effective operation of the wastewater treatment system under emergency conditions. The objectives of this emergency response plan will be as follows:

- To eliminate or minimize adverse effects from emergency situations affecting the treatment system;
- To develop procedures for properly responding to emergencies;
- To provide instruction for system personnel to ensure that they understand their responsibilities during emergency situations; and,
- To provide inventories of available emergency equipment and outline existing mutual aid agreements and contracts with outside organizations for specialized assistance.

It is important for the operators to recognize what procedures should be followed in the event of an emergency. Emergency situations are of varying degrees of seriousness. In any event, the operators should be concerned with:

- Safety of personnel within the plant and the surrounding area.
- Safety of equipment within the plant area.
- Best treatment of sewage, given the emergency situation.

There is a logical sequence of steps in responding to any emergency, which should be followed by the operator on duty. The response sequence includes identifying the emergency, investigating and assessing the severity of the emergency, determining the proper initial course of action, implementing the corrective action to rectify the situation and following up with a post-emergency investigation and report.

<u>Identify Emergency:</u>
This step is obvious for most situations and is essentially that of becoming aware that an emergency exists. Natural disasters, power failures, equipment breakdowns and injuries are usually rather dramatic and will seize the operator's attention almost immediately upon occurrence. Under certain circumstances, the operator may have prior warning of an impending emergency through weather reports or through trends in process or equipment performance.

Some impending emergency situations exist long before the operator is aware that a problem exists. These situations may produce a larger emergency that then becomes more immediate and obvious. Poorly maintained equipment may have minor breakdowns, which, if gone unnoticed, may lead to complete failure of the equipment with possible injury to unwary plant personnel. A spill or discharge of toxic or hazardous materials into the tributary sewerage system is another example of an emergency situation that may go unnoticed for an extended period of time. If no waste monitoring and warning system exists, the operator will not be aware of the emergency until a treatment process fails or until the plant alarm system activates.

Initial Investigation:
Once the operator becomes aware that an emergency situation exists or that a natural disaster is imminent, an initial investigation should be immediately initiated. This investigation is undertaken to assess the severity of the emergency and to gather the information necessary for determining the proper initial course of action.

Under emergency conditions, the operator should assess the seriousness of injury to personnel and damage to structures and equipment, noting possible impending damage that could occur if corrective action is not immediately undertaken. The operator should then list personnel and emergency equipment immediately necessary to remedy the situation.

Initial Action:
Once the severity of the emergency is known, the operator should make an immediate determination as to what initial action should be undertaken. This initial action usually consists of notifying responsible authorities and calling for necessary assistance in order of priority.

After the necessary calls, the operator should immediately initiate action within specified limits to remedy the situation. The operator should not endanger himself or other plant personnel by undertaking tasks for which the proper personnel or equipment are not available. If the operator is not familiar with first-aid techniques; he should not attempt to move injured persons unless further danger exists. Moving an injured person or attempting first-aid without proper knowledge of the technique may cause more serious, permanent injury.

Corrective Action:
If handling the emergency is beyond the operator's capabilities, he should wait until the necessary assistance is available. The operator should immediately appoint the proper personnel to supervise the corrective action. While corrective actions are being undertaken, the operator should notify all relevant agencies and persons not informed initially.

Corrective action should be continued until the emergency situation is completely reconciled. If the correction will take a considerable amount of time, necessitated by equipment orders, etc., the operator should consult with the necessary parties to outline a long-range program to complete the task.

Follow-up:
After the emergency situation has been corrected, the operator should make every effort to

determine the cause of the emergency and to review the corrective actions implemented. The operator should then undertake preventive measures to minimize the possibility of recurrence.

In the case of accidents, the operator should institute stricter safety practices, as outlined in the WPCF Manual of Practice No. 1, Safety in Wastewater Works. In the case of equipment failure, if negligence was not the problem, then a revised maintenance schedule would be the most likely preventive measure. For natural disasters that cannot be prevented from recurring, corrective measures may be undertaken to minimize the severity of the emergency. In any case, the procedures in dealing with an emergency situation should be reviewed to develop more effective courses of action.

For all emergencies, the Massachusetts Department of Environmental Protection, Division of Water Pollution Control should be notified and a follow-up report made, detailing what happened and how the situation was handled. Also, the operator should ask for and expect assistance from this agency when the situation warrants. This agency was established not only to regulate plant design and operation, but also to assist the operator in meeting the effluent requirements.

<u>Emergency Preparedness:</u>
In order to alleviate confusion during an emergency, and to be prepared for emergency situations, the following items are recommended:

- A telephone list of emergency numbers should be posted at all telephones. The list should include fire, police, utility companies, highway department, sewer department personnel and others who should be contacted during emergencies.
- At times of predicted storms or other natural phenomena that may create emergencies, all relevant personnel should be on duty at the treatment plant.
- Arrangements for the use of battery powered radios and other necessary equipment should be made.
- All vehicles, diesel generators, portable pumps, compressors and other emergency tools and equipment should be fueled and in good repair for immediate and prolonged use.
- Develop a program for training personnel in emergency operation procedures. Work closely with Town Police and Fire Departments (who are familiar with such programs).

<u>Summary:</u>
This section has outlined a general pattern of response actions that the operator should follow in responding to emergencies. In most small emergencies the operator will go through these steps automatically; however, they should be reviewed periodically in order to effectively deal with major emergency situations. In general, the pattern of response actions is:

- Identify the emergency.
- Investigate and assess the severity of the emergency.
- Take initial action and notify responsible authorities.
- Implement corrective action to rectify the situation.
- Follow up with an investigation to prevent or minimize future similar emergencies.

8.4 Possible Emergency Conditions

In a treatment system, the following emergency situations may develop the need for modifying the normal operating, maintenance and processing procedures.

- Failure of commercial (prime) power;
- Storms;
- Explosions;
- Fires;
- Hydraulic overloading, ruptures and blockage;
- Equipment breakdown and process failures;
- Spills of oil, toxic or hazardous materials into sewers or at the treatment works; and,
- Personnel injury.

Some of these situations can also produce additional emergency situations requiring decisions that will have to be assigned on a priority basis; i.e., a storm could directly create or cause (1) failure of commercial power to treatment plant and pumping station; (2) flooding conditions; (3) failure of the alarm system; (4) personnel injuries; and (5) hazardous transportation conditions for maintenance and operating personnel, repair of equipment or removal of injured. The listed situations are analyzed in detail through out the remainder of this section

Failure of Commercial (Primary) Power:

Partial or complete loss of primary power to motors, controls, alarms and reporting systems at the wastewater treatment plant can result in a complete inability to transfer the raw sewage through the treatment plant and impairment of the efficiency of the sewage processing and handling. All components of the treatment plant and exterior pumps are connected to an emergency generator equipped with an automatic power transfer switch. In the event of a power failure all essential equipment will automatically resume operating sequentially. Because such an event sets off the equipment failure alarm, the appropriate personnel will be automatically notified. It is advised that the appropriate personnel visit the facility immediately after a power failure occurs to ensure that all equipment is properly operating.

The pattern of response will be influenced by the extent and the duration of the electrical failure. The longer a power failure continues the greater the extent of the corrective and notification activities. The severity of the power failure will be dependent upon the time of the year, cause of the loss of power and estimated time that power will be off.

In the event of a power failure the operator should immediately notify the Plant Chief Operator, the plant electrician and the electric utility company. The operator should not attempt to correct an electrical problem on his/her own. The operator should wait until experienced electrical personnel arrive on the scene and allow them to take corrective action.

After restoration of the primary power supply, normal operation of the plant shall be resumed by a manual start-up of the equipment that was not operational during the power loss. Some equipment will restart automatically when power is returned.

Storms:

In addition to disruption of the primary electric power and possible flooding damage, storms can result in felled trees, broken branches or downed utility poles which may disrupt the alarm reporting system or telephone communications, stop or greatly hamper movement of personnel and increase the problems of restoring operations.

An assessment of severity of other effects will depend upon the character of the damages as they affect the sewer system operation.

- Rupture of water distribution lines that can become polluted is of prime importance.
- Felled trees, branches, electric or telephone poles that will hinder or stop travel required for repair are of secondary importance.
- Damaged buildings and structures take third priority.
- Hazards such as washouts, holes in the road, and impassable areas where pavement has been destroyed, are of lesser importance.

In the event of fallen trees, telephone poles and the like, the operator should immediately notify the Police, Fire and Highway Departments and the affected utility company. Fallen trees, branches, poles and the like will be the responsibility of the Owner and the Power and Telephone Companies. All power lines should be treated as being "live" and should only be handled by the utility companies. Trees or branches held up by electric wires should be moved only in extreme emergency and, if moved, extreme care should be exercised to avoid collapse, which may cause fires or electrocution.

Explosions:

Explosions can result from ignition of accumulated dusts, sewer or petroleum gases. Explosions may occur in pump rooms, wet wells, sewer manholes, large trunk sewers, chemical rooms, or laboratories. Explosions may disrupt power, cause flooding or damage sewers, structures or other equipment and may be accompanied by fire.

A brief investigation of the explosion should be made. The fire department must be notified immediately, telling them the nature and location of the mishap and whether or not any personnel have been injured.

An explosion with accompanying fire will probably create structural damage, disrupt electrical circuits and damage pumps and piping. Any fire should be contained, if possible, using the fire extinguisher or by closing all entrances to the area. Electrical power and water flow to the area should be shut off from outside the affected area.

If structural damage has occurred, do not enter the control room, but rather make an examination from the exterior through the doors. Determination of the soundness of the structure should be made by a structural engineer. If damage is not apparent, the structure may be entered for assessment of damage to equipment, pumps, piping or electrical system and the shut-down of affected systems. The first entrance should be made cautiously and preferably after the fire department has arrived.

Explosion in a manhole or trunk sewer will expend itself upward by blowing off the manhole cover and through the connecting pipes. Upon arriving at the scene, it should be determined if any damage has been done by the cover in flight. Also, the manhole and piping should be checked for damage. Adjacent manholes should also be examined since some of the explosive pressure will pass through the pipes to these structures.

After the immediate danger of the explosion has passed and any fire extinguished, the operator should implement the following plan:

- Determine what pieces of equipment are available for processing and what piping paths are available for handling the wastewater. Appropriate alterations in the normal process to continue or resume treatment. At all times, the safety of personnel and equipment must be considered.

- If pumping equipment or piping is damaged, flow may have to be rerouted through other pumping units not normally used for this purpose. If other pumps or equipment are not available, portable pumps and temporary piping may have to employed. Breaks in pipelines should be isolated temporarily by closing valves and repaired as soon as possible.

- Clean up all sewage, oil, gasoline and chemical spills immediately and vent the area against an accumulation of explosive vapors.

- Damaged electrical equipment, switches and controls should be temporarily by-passed or taken out of service completely and replaced at the earliest convenience.

- If a cubicle or section of a motor control center is damaged, locate if possible, an undamaged plug-in unit which services a nonessential piece of equipment and make the connections to that unit, until the damaged unit is repaired or replaced.

- Damage to instrumentation units will necessitate replacement of the units.

Operation will have to be continued until repairs or replacements are made. Manual measurements of essential parameters should be made wherever practical.

- Wiring circuits that are damaged must be replaced immediately, before connections can be made to new or repaired parts.

No structural damage should be considered minor until it has been inspected by professionals. The building inspector should be notified as soon as possible and professionals hired to make temporary and permanent repairs. The affected areas should be closed off until after an inspection has been completed by persons experienced in this field and any temporary repairs have been made. Areas adjacent to the affected areas should be covered with tarpaulins to prevent damage to equipment, instruments and records by inclement weather, spillage, broken pipes and the like.

Manhole or pipeline explosions will constitute a minor emergency. Portable pumps and temporary piping may have to be employed during repair operations. Damaged manholes must be repaired as quickly as possible. Paved inverts can be restored by blocking incoming lines and setting brick with hydraulic cement or other quick setting compounds. If regular cement is used, it can be protected by using a length of stove-pipe or similar material for temporarily carrying sewage through the manhole and sealing the annular spaces at the pipes. Cracks in the walls can be sealed using hydraulic cement. Displaced frames should be reset.

Fires:

Fires at the treatment plant will typically be of wastepaper, oily cloths or electrical types and may also be the result of explosions, spontaneous combustion, smoking or arson. All structures have been built to be fire resistant, comprised of as little combustible material as possible. Fire extinguishers, dry-chemical, type A, B or C, are installed within the building.

Determination of the extent of damage caused by the fire to equipment, such as motors, controls, instruments and circuits is of primary importance. The investigation of the cause of the fire is of secondary importance. The severity of the fire will depend on the damage done to essential items of equipment.

In the event of fire, the operator should immediately notify the Fire Department and the Owner.

Prevention of fire damage is of utmost importance and can be accomplished by carefully adhering to the following:

- Empty wastebaskets daily.
- Clean up all oil and chemical spills immediately and completely.
- Dispose all oily, greasy or paint cloths after each use by putting them in airtight, fireproof metal containers. Do not leave them lying around!
- Check all oil, fuel and gasoline drips and repair leaks immediately.
- Know where all fire extinguishers are located, which ones to use for which type of

fire, and how to use them.
- Check extinguishers semiannually and have them recharged annually.

If present when a fire starts, move immediately to the nearest exit door. Fire extinguishers are mounted near the door. Activate the appropriate extinguisher and try to put out the fire keeping between the fire and the exit. If the fire cannot be put out with one extinguisher, retreat towards the door and exit the structure.

Hydraulic Overloads, Ruptures and Blockage:

Hydraulic overloads will be caused by water entering the sewers through broken pipes, flooded manholes or leaking joints. Hydraulic overloads may be the result of floods, hurricanes, severe storms or infiltration due to high ground water conditions. Ruptures may result from flooding, earthquakes or explosions. Blockage will generally result from the deposition of foreign material in manholes, leaking pipes, accumulation of solids in sewers that have "flat" slopes or pipeline breaks.

Hydraulic overloads will be marked by unusual increases in the flow characteristics as recorded by the flow meters. Ruptures will be indicated by an increase or decrease in flow to the treatment plant. Blockage will result in backing up sewage in the lines above the point of stoppage resulting in the leaking of sewage at manhole covers or where watertight covers exist, sewage entering adjacent structures through service connections.

Equipment Breakdowns and Process Failures:

All components of the treatment plant are connected to a central alarm system in the Equipment Control Panel. Should an equipment failure or overload occur, an alarm light and horn mounted on the treatment plant building will be actuated.

Upon discovering an equipment failure, the operator shall immediately make the necessary arrangements to replace or repair the failed unit. The failure of major equipment requires the prompt notification of the Department of Environmental Protection, Division of Water Pollution Control, Central Regional Office in Worcester.

Breakdown of essential equipment, such as pumps, aeration facilities and settling tanks, could endanger the entire treatment operation. Duplicate units have been provided for most of the essential equipment such as pumps and blowers; however, failure of any piece of equipment may result in a partial failure of the treatment process, which will necessitate process adjustments, and may also result in a loss of time and costly repairs.

Overloading of the equipment will initiate audible and visual alarms in the instrumentation panel. As soon as an alarm is sounded and the location of the emergency displayed on the equipment control panel, the operator should investigate and determine the cause and extent of the emergency. This investigation should minimize the possibility of permanent damage to equipment, flooding or injury to personnel.

If the failure is electrical in nature and is not the result of primary power source failure, the switch handle on the motor control center for that piece of equipment should be shut off, the reset button pushed and the handle set to "ON". If the unit fails to run, the standby unit should be made the lead unit. The unit that failed should be disconnected and checked out by the plant electrician.

When any major piece of mechanical equipment fails, the standby unit should be placed in operation prior to investigating the failure. Surety of the standby unit's operation must be ascertained prior to working on the failed unit to ensure continuation of the process. The failed unit should then be checked carefully to pinpoint the cause of the failure. Any part that is damaged should be replaced from the parts inventory of the equipment supplier. Spare parts should be stocked as recommended by the manufacturer and an inventory maintained. New parts should be ordered to replace those used for repair.

Normally, process failures can be attributed to equipment failure, elimination of some feature of the treatment process or may result from oils, acid, bases or toxic wastes in the influent. The presence of these materials will generally be caused by accidental spills or illegal discharges. The appropriate emergency action necessary to correct the situation is covered under the section entitled "Spills of Oils, Acids, Toxic or Hazardous Materials."

All electrical equipment is equipped with thermal overload protection that trips at the appropriate motor starter in motor control centers or individual motor starters.

Spills of Oils, Acids, Toxic or Hazardous Materials:

Spills of oil, acids, toxic or hazardous materials into the treatment works or the sewer system may be deliberate or the result of an accident with spillage entering the sewer system through manhole covers or service connections.

Deliberate spills of deleterious materials into the sewer system are not likely to be discovered until they appear at the treatment plant and interfere with the treatment process. Generally, accidental spills will not be known until evidence of the accident reaches the plant. Spills at the treatment facility by plant personnel are usually known, enabling corrective measures to be initiated immediately.

When a spill results from an accident on city or state roads where sewer lines are installed, the Fire Department or others will usually be called to clean up the spill. In some instances they may inadvertently flush the oil, gasoline or other materials down the storm drainage system. Some of this flushing may also enter the sanitary sewer system. If the chemical is unidentified, attempt to get a sample for test.

Deliberate spills will be harder to investigate since they will often be done illegally in batch dumpings. Samples should be obtained and analyzed to determine its identity and probable source. If a prolonged spill occurs, a systematic search starting at the treatment plant may be necessary.

The operator will be responsible for ensuring that corrective measures are undertaken. The operator should coordinate actions by the Police and Fire departments, and the Department of Public Works.

Liquid spills shall be flushed heavily down the sewer line to reduce their concentration. Acids or bases will have their concentrations reduced by the flushing operation.

Powdered substances should be flushed to the next manhole. The outlet side of the downstream manhole should be plugged to prevent the material from reaching pumping stations or the treatment plant. The manhole should be pumped out and the material properly disposed of.

Personnel Injury:

Personnel injury can result from falls, from working in tight places, cuts, abrasions or broken bones resulting from improper use of tools, being overcome by gas, electrical shock, carelessness, slipping into tanks or manholes and during plant emergencies.

The operator should immediately call a physician, ambulance service, Police or Fire Department and the Owner.

Personnel should have available and be familiar with a copy of a first aid manual such as is published by "The American Red Cross."

Cleanliness, proper maintenance, correct operating procedures, a team approach to work in remote or hazardous areas, and properly coordinated safety programs are the main ways of minimizing the risk of personnel injuries.

8.5 Emergency Readiness Program

Emergency Telephone Numbers
A list of emergency telephone numbers should be completed and posted in a conspicuous location near each telephone in the plant.

The plant operator should be given the responsibility for maintaining the accuracy of the list. This list should be checked periodically for accuracy and changes made to all posted lists.

Emergency Equipment Inventory
An inventory should be made of equipment, materials and chemicals available at the treatment plant that can be used in case of an emergency. Any additional emergency equipment and supplies required should be purchased and stockpiled or arrangements made to obtain these items through outside contracts.

Treatment Plant Records
A program should be established for the protection of essential records, plans and reports. All originals should be stored in the Control Room. These items must be available for immediate use and can be reproduced as required.

Coordination with Police and Fire Department
Establish a program for local fire and police departments to periodically review the treatment plant for adequacy of fire prevention and security measures. These agencies should be made aware of any potential chemical emergencies.

The treatment plant's emergency response action should be coordinated with the local Police and Fire departments. Coordinating instructions are outlined below and consideration should be given to the items in the following checklists:

a. Police Department Checklist
   1) Critique existing treatment plant security measures.
   2) Make routine checks of treatment plant.
   3) Notify treatment plant in the event of a street spill of hazardous materials.
   4) Be prepared to assist during emergencies at the treatment plant.

b. Fire Department Checklist
   1) Routinely check fire-fighting equipment at the plant and inspect the plant for potential fire hazards.
   2) Provide first-aid instruction to treatment plant personnel.
   3) Coordinate with treatment plant personnel on safety precautions to be used with methanol gas.

9.0 SAFETY

The first rule of any safety program is good housekeeping. Work areas should be well lighted. Service walkways and handrails should be inspected periodically to ensure they are in suitable condition and free of rust. Floors should be well swept and free of spills that may cause slipping. For safety reasons, the plant should have a fully stocked first-aid kit, complete with a sufficient supply of gauze, bandages, first-aid creams, disinfectants and eyewash kit. An adequate supply of fully charged fire extinguishers should also be maintained at the plant in conspicuous locations.

In addition to the preceding, personal hygiene is of utmost importance when working around wastewater. It is advised that hands and fingers be kept away from the eyes, mouth, ears and nose to prevent the risk of infection. Gloves should be worn whenever cleaning or repairing equipment which is in contact with wastewater or when collecting wastewater samples. Any cuts or scratches received while working at the facility should be attended to immediately. As a further precaution, gloves should be worn when hands are chaffed, burned or when the skin has been broken.

Noxious gases and vapors can present a serious hazard in wastewater treatment facilities and related appurtenances. Operating personnel should be thoroughly familiar with the characteristics, sources and means of testing for the common gases associated with sewage treatment facilities.

Safe practice requires that, before entering any manhole, pump chamber or enclosed tank, tests should be conducted for the presence of dangerous gases. The chamber should be blown out with fresh air if there is any evidence of flammable or toxic gases. A hydrogen sulfide kit is recommended for use in testing the plant's pretreatment and equalization tanks.

As a further precaution, operating personnel should not enter any confined space unless accompanied by someone capable of providing assistance in the event of an accident. Should the plant operator be alone at the plant and the need to enter an underground tank or confined area presents itself, the operator should contact the main office of the retail center so that a member of the maintenance or security staff can be dispatched to provide assistance. A safety harness and rope should be worn at all times by the person entering the chamber.

Employee hazards in wastewater treatment facilities include exposure to: physical injuries, body infections, oxygen deficiency, noxious gases or vapors, etc. These occupational hazards are largely avoided by the execution of safe practices and the use of safety equipment. It is the responsibility of plant operators to acquaint themselves with the hazards associated with facilities maintenance and operation and to take steps to eliminate them.

OSHA standards require the management to furnish safe tools, equipment, layout, and materials, and to define policies that will keep them properly maintained in safe working condition. In addition, a list of emergency telephone numbers and contacts should be available at all telephones.

It is also the management's responsibility to select workers who are physically and mentally capable of performing the work required and possess the necessary aptitude for the specific tasks within the facilities. In addition, the management must provide adequate education and training in accepted safety procedures.

Workers have a responsibility to themselves, their families, and their jobs to do everything they can to prevent personal injuries. This can be accomplished by conformance to established safety regulations and utilization of the proper safety equipment in the performance of the daily work routine. Human error is the most significant cause of accidents and it is the employee's responsibility to perform their job safely.

Development of a safety program is a necessity. The purpose of this safety program should be to define the principle under which the work within the plant is to be accomplished, and to make the employees of the plant aware of safe working procedures.

Perhaps the most essential element of a good safety program is the incorporation of some form of safety training. The purpose of safety training is to convey the importance of safety to the employees at the plant. Safety training can be accomplished through safety manuals, safety meetings, safety posters placed in strategic areas in the plant, and a safety suggestion program.

The overall danger of accidents is the same whether in manholes, pumping stations or treatment plants. These hazards include:

- Physical injuries;
- Body infections;
- Noxious gasses or vapors; and,
- Oxygen deficiency.

In many areas of the plant where sewage solids collect and are pumped, sludge gas may be produced. Sludge gases may contain low levels of life-sustaining oxygen. Sludge gas may also contain explosive concentrations of methane. However, the most important point to remember is that areas may contain toxic concentrations of hydrogen sulfide and are, therefore, the greatest hazard.

In wet wells and pump suction wells, flammable vapors such as gasoline and solvents may be present. Gasoline vapor is heavier than air, and presents the hazards of asphyxiation and explosion. Such places should be provided with forced ventilation. All electrical switches, lights, motors and fixtures should be explosion proof, and smoking prohibited.

Ammonia, which is explosive and harmful to the respiratory tract and eyes, may be found in sewers or enclosed treatment plant areas.

Solvent vapors, resulting from the discharge of gasoline, lubricating oils, benzene, naphtha and similar solvents and petroleum products, may cause suffocation or possibility of explosion.

A safety-training program should be instituted by the supervisory personnel to prevent injuries. Following is a list of some of the items that should be incorporated in the safety program:

- Employee training
- Maintenance of safe working conditions
- Medical and first aid
- Accident record system
- Accident investigation
- Safety program:
    a. storage facilities
    b. illumination
    c. ventilation
    d. fire control
    e. water supply
    f. safety facilities considerations
    g. personal hygiene
    h. safety equipment
    i. good housekeeping
    j. oxygen deficiency
    k. electrical safety
    l. hazardous operations
    m. material handling
    n. ladder operations

List of some safety equipment maintained on-site or available to the plant operator (quantities will vary):

- Three conductor grounded extension cord (50' long)
- First-aid kit

- Self-contained breathing apparatus
- Hose mask
- Safety harness and line
- Warning signs and tags
- Portable air blower
- Rubber gloves and boots
- Hard hat
- Fire extinguisher
- Safety eye glasses
- Oxygen Deficiency Monitor
- Explosive gas detector
- Hydrogen sulfide detector
- Ammonia detector
- Rain gear and/or chemical suit
- Volt meter or indicator
- Speedy dry for spills (chemicals, polymer, lubricants, etc.)

10.0 UTILITIES

The following utilities provide service to the treatment plant facility:

Electric -	NStar Electric	800-592-2000
Gas -	Keyspan Company	800-233-5325
Telephone -	Verizon AT&T	800-870-9999 800-222-0300
Water -	Acton Water District Commission 693 Massachusetts Avenue PO Box 953 Acton, MA 01720	978-263-9107 phone 978-264-0148 fax www.actonh2o.com

11.0 MAINTENANCE SCHEDULE

11.1 Spare Parts and Supplies

The following is a listing of spare parts and supplies that should be available to the plant operator for the maintenance and repair of the treatment plant and related appurtenances.

RBC Feed Pumps

- One (1) Set of Gaskets
- One (1) Set of Mechanical Seals
- Two (2) float switches

Final Effluent Pumps
- One (1) Set of Gaskets
- One (1) Set of Mechanical Seals
- Two (2) float switches

Backwash Pumps
- One (1) Set of Gaskets
- One (1) Set of Mechanical Seals

Mudwell Pumps
- One (1) Set of Gaskets
- One (1) Set of Mechanical Seals

Aerobic RBC
- One (1) Aerobic RBC Drive Chain
- One (1) year supply of lubricants req'd for operation and maintenance

Clarifier
- One (1) Unit of grease for gear reducer
- One (1) Unit of oil for gear reducer

Denitrification Filter/Aeration System/UV System
- Two (2) Blower Drive Belts
- Two (2) Solenoid Valve
- One year supply of the manufacturer's recommended lubricants
- Two (2) spare diffuser plates
- Two (2) Float switches for filters
- Two (2) Ultra Violet lamps
- One gallon on Ultra Violet lamp cleaning solution
- One (1) 100 lb. bag of filter media

Effluent Flow Meter & Recorder
- Six (6) pens for the recorder.
- One (1) year supply of recording charts

Control Panel
- One (1) Output Card
- One (1) Input Card
- One (1) Motor Starter for each size
- Ten (10) of each type lamp
- One (1) relay of each type

11.2 Maintenance Schedule

For detailed maintenance procedures on individual components, refer the Operation and Maintenance manuals included in the Appendices.

TABLE 11.2 – Maintenance Schedule & Inspection Frequency

Equipment	Daily	Twice Weekly	Weekly	Every 500 Hours	Every 30 Days	Every 1,000 Hours	Every 90 Days	Every 2,500 Hours	Every 3,000 Hours	Every 6 Months	Yearly
REMOTE PUMP STATIONS (4)											
Check Pump Operation	X										
Check Float Switches					X						
Inspect Emergency Overflow Tanks					X						
PRETREATMENT TANK											
Remove Scum Accumulations										X	
Remove Sludge Accumulations										X	
Check Depths of Scum & Sludge					X						
FLOW EQUALIZATION TANK											
Check Pump Operation	X										
Check Float Switches					X						
AEROBIC RBC											
Inspect Bearings			X								
Lubricate Bearings							X				
Check Media Retainer Clamp										X	
Grease Stub-Ends & Bearings										X	
Inspect Chain & Sprocket					X						
Inspect Drive Assembly			X								
Change Speed Reducer Oil										X	
Lubricate Motor Bearings										X	
Change Chain Casing Oil										X	

(continued next page)

TABLE 11.2 – Maintenance Schedule & Inspection Frequency (continued)

Equipment	Daily	Twice Weekly	Weekly	Every 500 Hours	Every 30Days	Every 1,000 Hours	Every 90 Days	Every 2,500 Hours	Every 3,000 Hours	Every 6 Months	Yearly
AEROBIC RBC (cont.)											
Visual Inspection of Biomass	X										
Wire Brush & Paint Tank Rust											X
Load Cell Pressure Readings				X							X
CLARIFIER											
Visual Inspection	X										
Grease Gear Reducer Fittings					X						
Change Speed Reducer Oil								X			
Check Blower Operation	X										
Wire Brush & Paint Rust Spots											X
DENITRIFICATION FILTER											
Visual Inspection of Effluent	X										
Record Back-wash Counter Figures	X										
Inspect Flow Meter	X										
Calibrate Flow Meter											X
Inspect Disinfection Unit	X										
Clean Disinfection Unit					X						
Replace UV Bulbs											X
Inspect & Clean Quartz Sleeves when intensity < 2.8 mW/cm^2					X						
Lubricate Flow Splitter Ends					X						
Check Liquid Level Sensors			X								
Drain & Refill Shaft Seal Reservoir in Backwash Pumps				X							
Inspect Backwash Pump Seals										X	
Clean Effluent Troughs			X								
Wire Brush & Paint Rust Spots											X

TABLE 11.2 – Maintenance Schedule & Inspection Frequency (continued)

Equipment	Daily	Twice Weekly	Weekly	Every 500 Hours	Every 30Days	Every 1,000 Hours	Every 90 Days	Every 2,500 Hours	Every 3,000 Hours	Every 6 Months	Yearly
CHEMICAL FEED SYSTEMS											
Visual Inspection of Methanol and Alkalinity Levels	X										
Inspection of Pump and Mixer Operation	X										
FINAL EFFLUENT PUMP CHAMBER											
Check Pump Operation	X										
Check Pump Switches					X						
EFFLUENT DISPOSAL SYSTEM											
Inspect Distribution Boxes					X						
Inspect Monitoring Wells							X				
EMERGENCY GENERATOR											
Automatic Exercising			X								
Annual Inspection/Maintenance											X